Low-Voltage Grid Battery Energy Storage Systems Trial – Lessons Learnt Report No 2

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Contact:

Shiyam Selvarajah
Manager, Non Network Solutions
United Energy
Shiyam.Selvarajah@ue.com.au

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1. Summary

This document is the second Lessons Learnt Report for the United Energy (UE) Low-Voltage (LV) Grid Battery Energy Storage Systems (BESS) Trial (the project). The project is funded under ARENA's Advancing Renewables Programme (2020/ARP024). It fulfils an obligation under the Knowledge Sharing Plan to provide an update on the status of delivery of the project including sharing of results and lessons learnt.

This report provides an update on key lessons learnt during the delivery of the ARENA project. These lessons learnt broadly cover:

1) Project objectives
2) Stakeholder engagement
3) Cybersecurity
4) Technical and financial/economic outcomes.

2. Project Background

The United Energy Low Voltage Battery Energy Storage Systems project investigates the technical and commercial feasibility of using pole-mounted batteries connecting to the LV network to manage constraints on the distribution network and increase the hosting capacity of distributed photovoltaics (PV) systems. Forty (40) units will be installed across the United Energy network as part of the trial.

At the time of writing, field installation of the first of ten (10) units is imminent. Over the coming months monitoring and testing of energy, voltage and frequency management features will occur via remote communication on these units in response to network conditions, as the remaining 30 are commissioned. United Energy will analyse the results of all units to evaluate network benefits of the BESS units at each location and as an aggregated fleet of distributed energy resources.

Any parties interested in discussing the contents of this report directly with United Energy are encouraged to contact Shiyam Selvarajah, Manager Non-Network Solutions at shiyam.selvarajah@ue.com.au.

This lessons learnt report is available on United Energy's website[1].

[1] https://www.unitedenergy.com.au/arena-funded-projects/

3. Key Lessons Learnt

Table 1 lists the lessons learnt on the project objectives, challenges, experiences and how these were overcome.

Table 1: Lessons learnt on project objectives, challenges and experiences.

No	Situation	Action
1	At the start of the project, there was some uncertainty regarding roles/responsibilities between various teams involved in the project.	A formal Project Management Plan (PMP) was developed to identify how the project will be delivered along with details about resourcing, budgeting, milestones, roles and responsibilities and delivery methodology. UE also established a program level working group that meets on a weekly basis to track project progress and to fast track issue resolution. This working group includes a number of stream leads who were briefed on their responsibilities at the beginning of the project.
2	The use of emails to share information and key documents between internal teams and external parties was a key risk which might cause some cyber security issues. This resulted in lack of visibility and confusion between teams.	A project folder for the internal teams was established to share documents and key information about the project. The stream leads also took the initiative to ensure the project team is using the folder to share information. An external OneDrive folder was established to share information with external stakeholders.
3	The project had multiple streams (BESS design, control system, communications, IT and stakeholder engagement) that had to work together in delivering the project. At the start, it was challenging to understand all the key activities and critical paths due to lack of visibility/plan from each stream. This was also impacting UE's ability to track critical activities on the program master plan.	Each project stream lead was requested to develop a project plan in MS Project to track their key activities and timelines. This was regularly updated during the weekly program management meeting and was feeding into the program master plan. This assisted UE to identify and resolve upcoming risks and issues early.
4	There was a lack of clarity about UE expectations of a preliminary design against BESS supplier's understanding. BESS supplier's understanding of the preliminary design was more of a concept design which did not have to be verified by engineering calculations.	UE worked closely with the BESS supplier to better manage expectations. Weekly design meetings were held to review the project with the BESS supplier. The BESS supplier then reviewed the drawings with the project leads to ensure expectations were met prior to formal submission. For future projects, it is recommended to define preliminary design in the contract and also ensure both the BESS supplier and UE expectations are aligned during the project kick-off meeting.

No	Situation	Action
5	Trial projects involving development of new innovative technologies are very complex and have a lot of unforeseen challenges/issues which can impact the delivery timeline and cost. Trial projects should consider having additional contingencies, over and above a business-as-usual (BAU) project.	UE worked actively with internal and external stakeholders to manage unexpected issues as well as conducted comprehensive risk assessments. The issue resolution process was streamlined to ensure quick decisions are achieved to mitigate project delays and cost overruns.

Table 2 details the lessons learnt on stakeholder engagement, consultation and collaboration, including any issues encountered.

Table 2: Lessons learnt on stakeholder engagement, consultation and collaboration.

No	Situation	Action
1	Residents in a metropolitan suburb in the Monash Council area in Melbourne were notified on three separate occasions about the BESS installation. As a culturally and linguistically diverse (CALD) local government area, language barriers prevented several residents from sharing their concerns before construction. This may also affect community members' future ability to engage with new energy distribution technologies.	Monash Council was engaged to procure demographic data before the installation where this issue arose. Collaboration with local councils will continue to seek advice for language barriers before engagement. Partnerships will also be explored to increase UE's reach to hard-to-reach communities. UE will also utilise the market research platform Mosaic to support communications planning with hard-to-reach customers.
2	Members of the Southeast Councils Climate Change Alliance (SECCA) from regional Victoria raised concerns regarding bushfire risk. Members also raised concerns about customer impacts, highlighting the need for transparency around selection criteria	UE confirmed the fire safety controls at the SECCA and EAGA engagement meetings in October 2021. Fire safety tests will also be performed at the factory prior to installation and will be made available to the stakeholder engagement team. Site selection criteria took on board community feedback and was also made available on the UE website in December 2021.

No	Situation	Action
3	UE led community consultation received a low level of interest in one particular metropolitan suburb, with the majority of feedback received via email or telephone.	Dedicated stakeholder engagement advisor responds to incoming communications from the community. Consultations will also be explored with councils and other project partners to increase engagement from the community
4	Construction delays pushed back phase two of the first installations into February, raising concerns from the community about the reliability of the project timeline.	Stakeholder engagement team has worked closely with project engineers to understand the cause of delays and communicate back to the community. Future notifications will include mention of potential delays because of supply chain risks, with delay notifications issued immediately.

Table 3 details the lessons learnt on data collection, access, sharing, validation, usage, integration and cybersecurity.

Table 3: Lessons learnt on data management and cybersecurity

No	Situation	Action
1	UE identified through a gap analysis that there is a business need to implement the IEEE 2030.5 protocol for the control system and had to go through a learning journey.	UE enrolled key internal resources to complete a training course to fasten the learning curve for the new protocol. UE also reached out to other utilities and other industry partners to increase its understanding and expedite the implementation.
2	UE technical specifications had limited information to complete a full structural review of the mechanical design.	UE worked collaboratively with the BESS supplier to ensure business requirements were refined and addressed during the design phase of the project. The general lesson learned is that the more comprehensive and detailed the original specifications are, the less issues arise during the project execution.

No	Situation	Action
3	The initial drawings submitted by the BESS supplier did not meet UE drafting standards.	UE worked with the BESS supplier to improve the quality of the drawings for final submission. It was agreed that the BESS supplier draft team should work with UE drafting team directly to ensure drawing quality standards were met for the project. UE drafting team then reviewed drawing quality prior to final submission.
4	Cyber security concerns were raised regarding using the IEEE 2030.5 protocol.	UE worked with the technology supplier to ensure the concerns raised by IT security teams were addressed in the design. The UE BESS system will be using a dedicated Telstra virtual private network (VPN). All auxiliary protection equipment will also be hardwired and will not be allowed to be configured remotely. The main circuit breaker is designed to act independently to the BESS unit to mitigate any potential cyber security risks.
5	Given this is new technology, there are limited Australian standards available for addressing fire risks for grid-connected LV BESS solutions.	UE engaged an independent fire engineer to review best practise standards for the proposed application. UE and the BESS supplier worked with the fire engineer in accommodating all the recommendations to improve the fire safety.
6	There was some uncertainty regarding the height at which the BESS should be mounted.	UE decided to use the same height standard applicable for the installation of pole-mount distribution transformers for the BESS units. It was agreed to install the BESS units at a height of 3.6m. This approach was endorsed by the Work Practices team.
7	From prior experience, it was observed that significant time and cost was associated with onsite testing of protection and communications equipment on the pole during installation. This was based on zone substation commissioning and was deemed not practical for LV BESS installation.	In the design of the BESS units, UE engineered out this requirement by using a compliant LV moulded case circuit breaker with protection capability rather than a dedicated zone substation standard relay. This would considerably reduce the requirement for on-site testing. Protection and communications testing was proposed to be completed as part of the factory acceptance testing (FAT) rather than during site acceptance testing (SAT). This approach was endorsed by UE Secondary Protection team.

No	Situation	Action
8	UE had experience of having limited engagement with installation service providers during design phase. This resulted in increased installation effort and lack of access for maintenance.	UE established a mini project to engage service providers during the design phase of this project. An ergonomics review of the design was then completed to understand ease of access for maintenance. UE also engaged service providers' representatives in the safety-in-design (SiD) process to capture learnings from other projects early in the design.
9	Identified the need to develop an emergency management and operational plan for the network control centre (NCC) and Fire Rescue Victoria (FRV) in managing new assets introduced to the network.	UE reviewed the Country Fire Authority (CFA) Guidelines for Renewable Energy Installation and started engaging FRV and other key stakeholders early in design process. An emergency management plan will be developed before the project is completed to ensure all stakeholders are aware of the operational procures during an emergency event. UE will also organise training with the BESS supplier for key stakeholders to familiarise with the new asset.

Table 4 details the lessons learnt on the technical, safety, regulatory, financial/economic, legal, social/consumer aspects of the Project.

Table 4: Lessons learnt on technical, safety, regulatory, financial/economic, legal, social/consumer aspects.

No	Situation	Action
1	Technical: A limited pool of service providers for development and integration of IEC 2030.5 between the BESS and BAU systems required the engagement of an offshore provider. Delivery/lead-times for equipment was affected by supply chain issues resulting from the Covid-19 pandemic.	 The challenge of coordinating personnel in Australia and overseas for regular meetings was helped through video conferencing. A common, secure method of sharing files had to be established. Building-in extended lead times into the project schedule will be necessary for delivery of the 40 units.
2	Safety: Key issues have been related to fire safety.	Completed an independent fire engineering review (May 2021) and made design changes to address issues identified. Training and familiarisation sessions on the unit and emergency management plan to be provided to internal and external stakeholders, such as FRV.

No	Situation	Action
3	Regulatory:	The project received a ring-fencing waiver and there have been no further significant regulatory issues to date.
4	Financial/economic: Initial installation estimates for the BESS units were scrutinised as the project moved into delivery phase and actual pricing became available.	Validating initial cost estimates is critical in innovative projects such as this. With a program of 40 units, our knowledge on actual costings have developed as we pursue installation of the BESS units. Leveraging competition between installation providers is also important to find the most cost-effective installation plan.
5	Legal:	No further learnings from a legal perspective.

4. Conclusion

The lessons learnt throughout the UE Low Voltage BESS project highlight the complexities of developing new technologies that meet stringent network safety requirements and perform without negatively impacting surrounding customers on the distribution network.

The delivery of this project has been affected by supply chain and personnel constraints due to the Covid-19 pandemic. As supply chains recover and new technology providers enter the market, reductions in costs and time to deliver a similar project in future are expected.

Delivery, commissioning and testing of functionality and performance of the low voltage BESS units is the immediate focus of this project in the months ahead.

5. Glossary of Terms

The following terms are referenced within this document:

Term	Description
AEMO	Australian Energy Market Operator
ARENA	Australian Renewable Energy Agency
BAU	Business As Usual
BESS	Battery Energy Storage System
CALD	Culturally and linguistically diverse
CFA	Country Fire Authority

Term	Description
SEPP	State Environment Protection Policy
EMF	Electromagnetic Field
EPA	Environment Protection Authority
FAT	Factory Acceptance Testing
FCAS	Frequency Control Ancillary Services
FRV	Fire Rescue Victoria
LV	Low Voltage
MASS	Market Ancillary Services Specification
NCC	Network Control Centre
PMP	Project Management Plan
PV	Photovoltaic
SiD	Safety-in-Design
UE	United Energy
VPN	Virtual Private Network